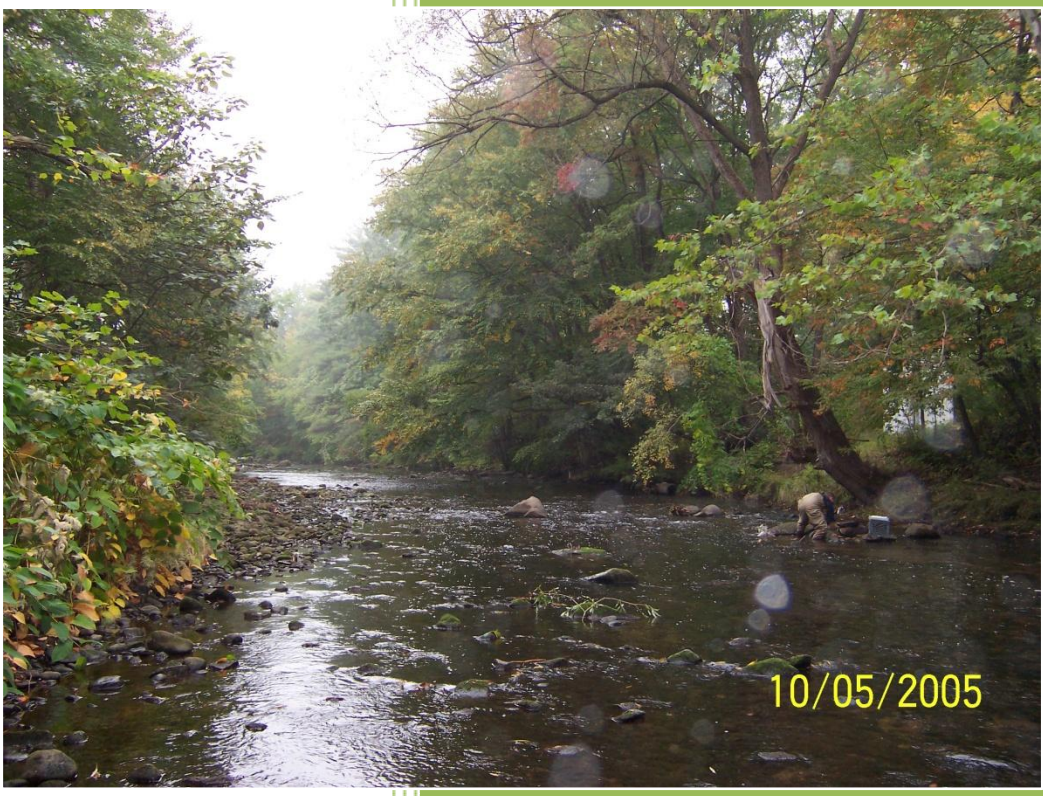
2010

Water Temperature by Volunteer Monitors



Connecticut Department of Energy and
Environmental Protection
Bureau of Water Protection and Land Reuse
79 Elm Street, Hartford, CT 06106

Work Summary Document
Volunteer Water Temperature Monitoring
EPA-Equipment Loan, Summer 2010

Mike Beauchene

Purpose: This document presents summary information regarding in situ water temperature data collected during the summer 2010 by volunteer organizations, the third consecutive year such data have been collected. Water temperature data in this document represent hourly values recorded from June 2010 through September 2010. The intent of the deployments was to obtain water temperature data during the 2010 summer months to inform both the sponsoring organization and Connecticut Department of Energy and Environmental Protection (DEEP) about selected stream segments. Water temperature can be inherently variable as it is influenced by factors including air temperature, riparian characteristics, and groundwater input. Water temperature itself is an important variable in determining the biology of a particular stream segment. This data can be used to complement ongoing watershed efforts to protect/restore aquatic habitat by both understanding water temperature variability and to be able to characterize the type of water temperature habitat (cold, cool, or warm water) of the stream segment.

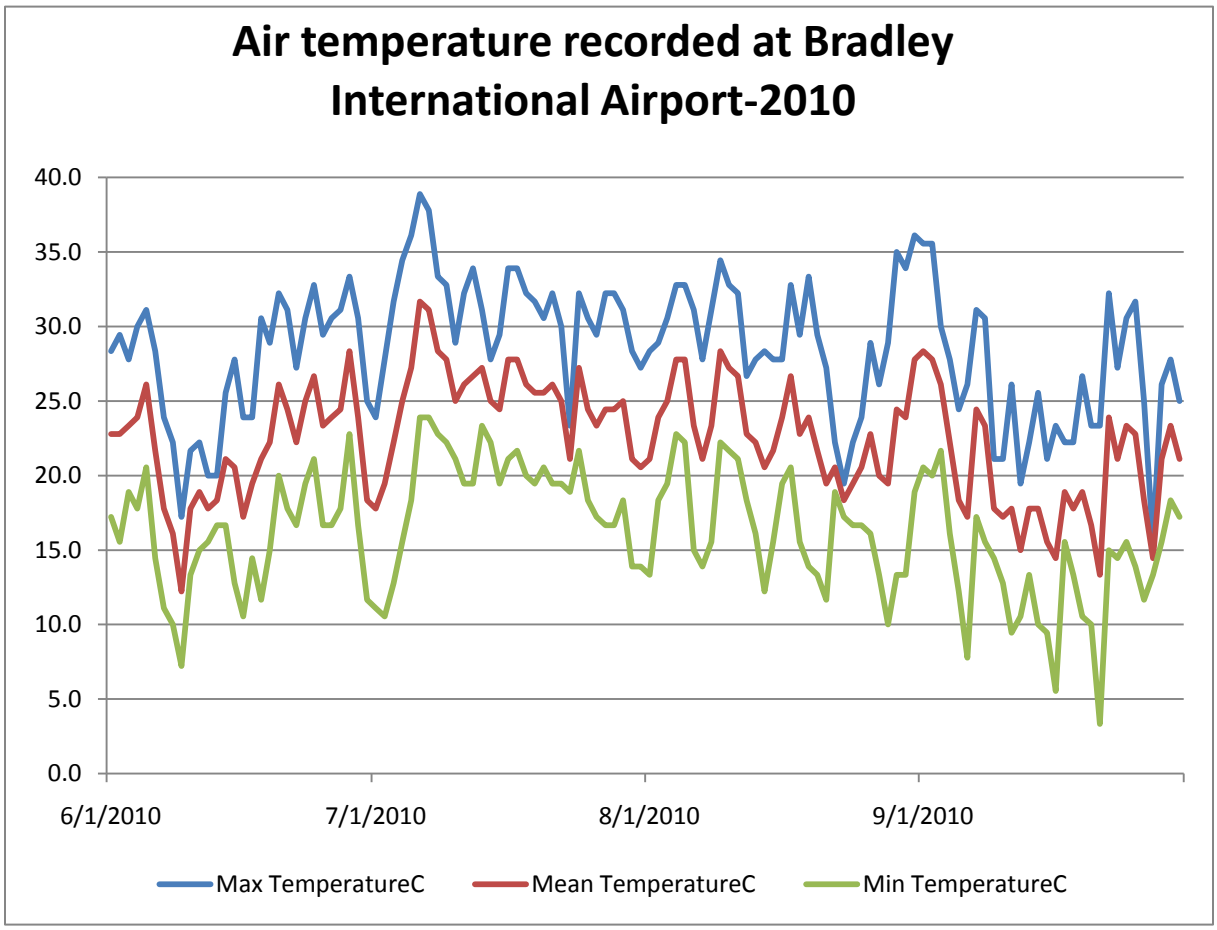
Who and What: Three organizations, The Farmington River Watershed Association (FRWA), The Nature Conservancy at Devil's Den (TNC), and Trout Unlimited-Candlewood Valley Chapter (TU) cooperated with this project (Figure 1). Data were obtained using 14 Hobo Water Temp Pro (Onset Computer Corporation, Bourne, Mass. http://www.onsetcomp.com) temperature probes supplied to DEEP as part of a volunteer monitoring equipment loan program sponsored by the US EPA and 12 owned by the Trout Unlimited-Candlewood Valley Chapter (TU). Probes were deployed at sites selected by the volunteer organization in late April and retrieved in mid October and set to record values once an hour following WPLR ambient water temperature standard operating procedure. For analysis data were considered from 6/1/2010 to 9/30/2010 for a total of 2928 data points for each probe except for Cherry Brook-1513 with 2208 data points due to removal of the probe on 9/4/2010. The probes were returned to DEEP where data were off loaded and appended into the ambient monitoring database.

Synopsis: Unlike the abnormally cool summer of 2009, summer 2010 was abnormally warm; in fact it was the warmest on record for New England. Every month except for December was several degrees warmer than normal. Coupled with high air temperatures was lower than normal rainfall for July, August, and September resulting in near record low stream flow for many streams across the state. At Bradley International Airport 31 days exceeded 90 F where 18 days is normal and 38 the record number of days (Figure 3). Changes from 2009 include; FRWA added 2 new stations due to loss of hobos due to stream channel configuration and/or vandals during 2009. TU lost 2 hobos due to stream channel configuration and 1 set of data to probe error. TNC were able to deploy 6 due to lack of HOBO to loan at time of deployment. As a result 2 stations were dropped for 2010.

Thank you to Alisa Phillips-Griggs (FRWA), Sally Harold & Cynthia Fowx (TNC) and Joe Hovious (TU) for taking the lead in deployment and retrieval of these temperature probes. Thank you to US EPA Region 1 for loan of the equipment. DEEP looks forward to obtaining additional water temperature data in summer 2011.

Findings: Data are presented by cooperating organization, FRWA (pp. 4-10), TNC (pp. 11-16), and finally TU (pp. 17-23). Within each section probe deployment location is presented in both a table and graphics. Water temperature data are summarized in a table by station id and month and graphics include box plots, individual dot plots, and smoothed histograms. The daily maximum temperatures are presented as a scatter plot and finally box plots of all 3 summer data sets (2008, 2009 & 2010). The summary for TU is divided into 3 sections due to the number of sites with data. The first are sites within the Deep Brook watershed, the second is 3 sites on the Pootatuck River mainstem, and the third are 4 sites on 2 streams outside of the Deep Brook/Pootatuck watershed. Cherry Brook-1513 (FRWA) was removed from the stream on 9/4/2010 and as a result has no September data for this report. Due to Minitab software requirements to have data values in equal length Cherry Brook-1513 data had to be plotted independent of other stations and added to graphics separately.

Figure 1. The locations of the 26 hobo water temperature probes that were deployed during the summer 2010. Probes deployed by FRWA and TNC were supplied through the US EPA volunteer monitoring equipment loan program. Probes deployed by TU are owned by that organization and have agreed to share their data for inclusion in this summary report. This was the third summer water temperature data were



collected at many of these locations.

Figure 2. Daily high, low, and average air temperatures for Bradley International Airport, Windsor Locks, CT 6/1/10-9/30/10 (source http://www.wunderground.com/). 2010 was the warmest air temperature year on record with all months except December being several degrees warmer than normal.

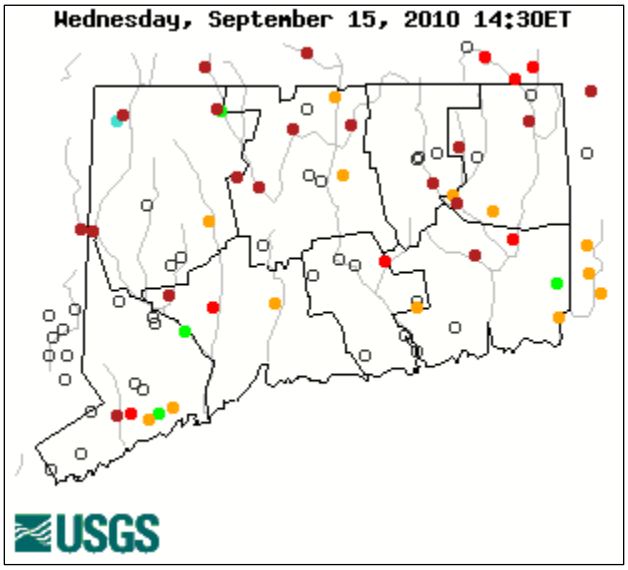
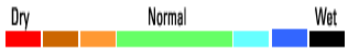


Figure 3. A graphic representing the stream flow condition for 9/15/2010 as provided by the United States Geological Survey (http://waterdata.usgs.gov/ct/nwis/rt). With much lower than normal rainfall during July, August, and September, many streams were at or near record low flow levels.



FARMINGTON RIVER WATERSHED ASSOCIATION:

Table 1. Location of 8 HOBO deployments by **Farmington River Watershed Association** during summer 2010. *indicates a new station for 2010.

Station ID	Stream	proximity	landmark	Basin id	Municipality	YLat	XLong	Segment ID
1739	Mad River	at	mouth	4302	Winchester	41.91879	-73.0582	CT4302-00_01
408	Morgan Brook	at	mouth	4305	Barkhamsted	41.90177	-72.9889	CT4305-00_01
1513	Cherry Brook	US	Route 44	4309	Canton	41.8365	-72.9295	CT4309-00_01
1130	Thompson Brook	75 m DS	Thompson Rd.	4316	Avon	41.77167	-72.8564	CT4316-00_01
1244	Nod Brook	US	Footbridge and Pond in Nod Brook FCA	4317	Avon	41.81971	-72.8245	CT4317-00_01
5949	Hop Brook	at	Route 10	4318	Simsbury	41.86859	-72.8061	CT4318-00_01
310*	Salmon Brook	Adjacent	Granbrook Park	4320	East Granby	41.9366	-72.7749	CT4320-00_01
2666*	Bunnell Brook	US	Route 179	4311	Burlington	41.7833	-72.9247	CT4311-00_01

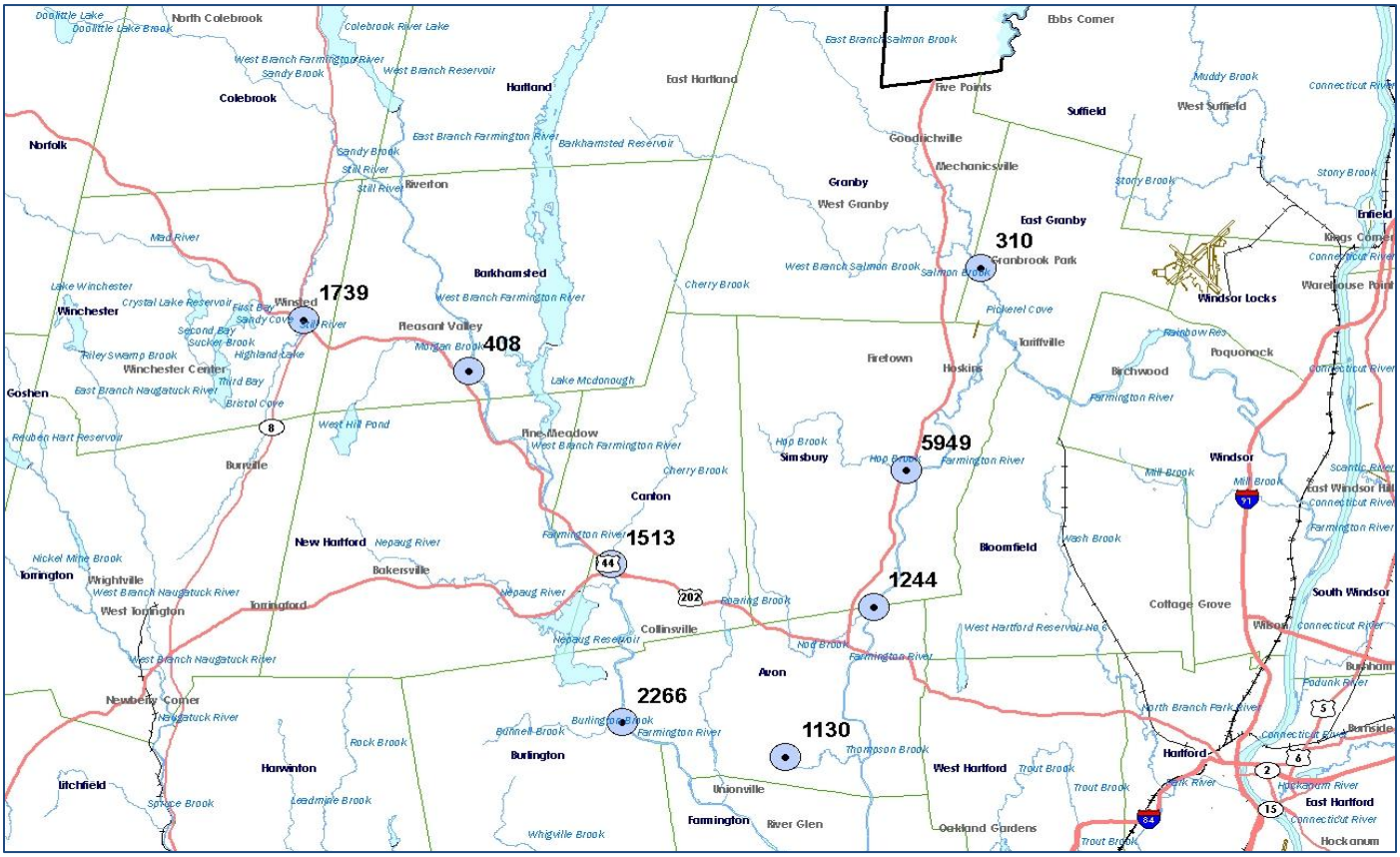


Figure 4. The locations of the 8 HOBO deployments by Farmington River Watershed Association during summer 2010. The number adjacent to the dot is the station id in Table 1 above.

Table 2. Summary statistics for each of the 8 **FRWA locations** with a HOBO water temp pro. The hourly data are summarized between 6/1/2010 and 9/30/2010. Values are water temperature in Degrees C. Cherry Brook-1513 has 2208 data points from June thru August due to removal of the probe on 9/4/2010.

Stream	landmark	WPLR station ID	2010 month	Max temp	Min temp	Mean temp	Avg of daily max	Avg of daily min	Maximum minimum temperature
Bunnell Brook	**Upstream Route 179**	2266	June	21.2	12.5	17.0	18.0	16.0	19.3
			July	22.5	15.2	19.7	20.8	18.7	20.5
			August	21.3	14.9	18.3	19.3	17.4	19.8
			September	21.4	11.7	16.3	17.3	15.3	19.4
Cherry Brook	**Route 44**	1513	June	22.7	13.7	18.4	19.5	17.4	20.9
			July	25.8	15.5	21.0	22.9	19.8	22.0
			August	25.0	15.4	19.4	21.5	18.0	20.7
			September	No data	No data	No data	No data	No data	No data
Hop Brook	**Route 10**	5949	June	22.6	13.7	18.7	19.9	17.6	21.1

			July	24.9	16.9	21.6	22.8	20.7	23.3
			August	24.0	17.0	20.1	21.3	19.3	21.9
			September	23.6	13.8	17.8	18.9	17.0	21.4
Mad River	**mouth**	1739	June	26.0	14.9	20.2	22.4	18.5	21.9
			July	31.2	16.4	23.2	26.7	20.6	22.9
			August	28.8	15.1	21.1	24.4	18.6	22.1
			September	27.9	11.2	18.1	21.2	15.8	20.7
Morgan Brook	**mouth**	408	June	22.6	13.2	18.2	19.6	17.0	20.6
			July	24.3	15.1	21.1	22.4	19.8	22.3
			August	23.1	15.0	19.5	20.5	18.4	21.6
			September	22.4	11.5	16.7	17.7	15.7	20.6
Nod Brook	**At footbridge in Nod Brook FCA**	1244	June	25.0	15.6	20.2	21.8	18.9	22.4
			July	26.4	17.4	22.7	24.2	21.4	23.9
			August	25.8	16.5	20.8	22.1	19.6	22.3
			September	24.2	13.2	18.2	19.5	17.1	21.7
Salmon Brook	**Granbrook Park**	310	June	22.2	13.9	18.0	19.2	17.0	20.0
			July	24.0	16.0	20.6	21.9	19.4	21.5
			August	22.7	15.5	18.8	19.9	17.8	20.1
			September	21.6	12.6	16.5	17.6	15.6	19.5
Thompson Brook	**Thompson Rd.**	1130	June	24.3	13.8	18.7	20.5	17.3	20.5
			July	25.5	16.4	21.5	23.2	20.1	22.4
			August	24.6	16.6	20.4	21.9	19.2	21.7
			September	24.8	13.5	18.1	19.5	16.9	21.3

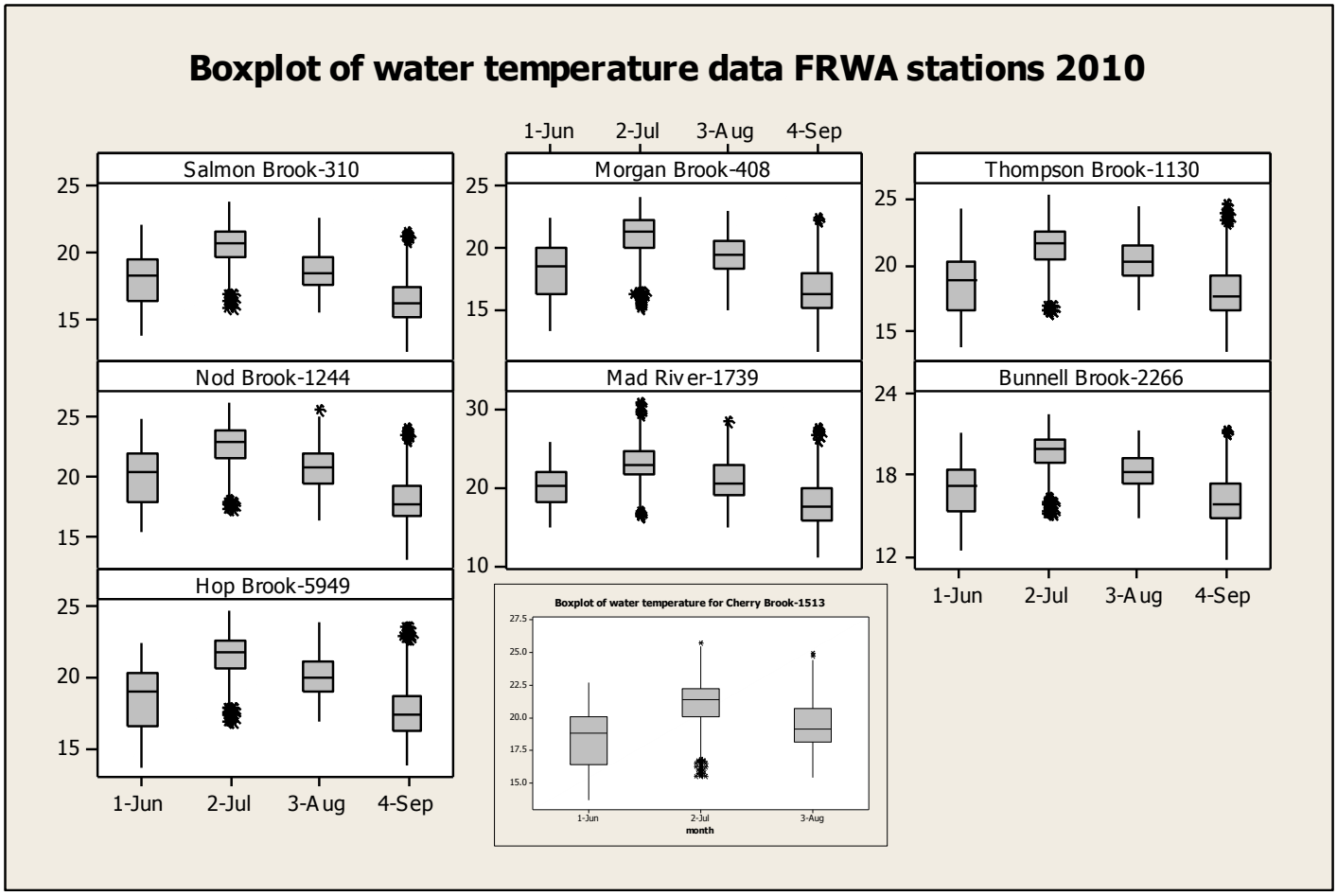
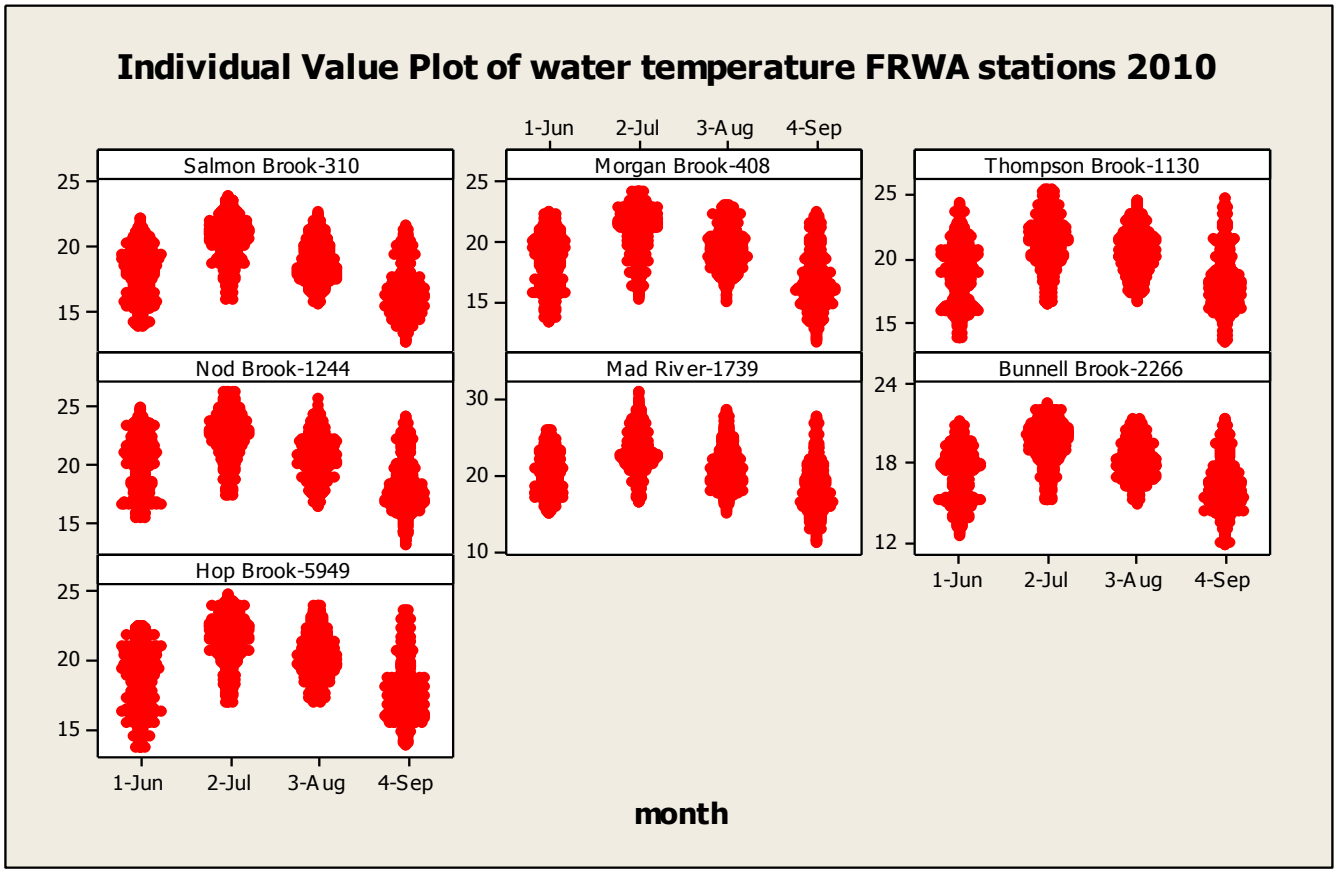


Figure 5. The distribution of hourly water temperature values by month recorded from June thru September 2010 for stations selected by the Farmington River Watershed Association. Cherry Brook-1513 has 2208 data points from June thru August due to removal of the probe on 9/4/2010.



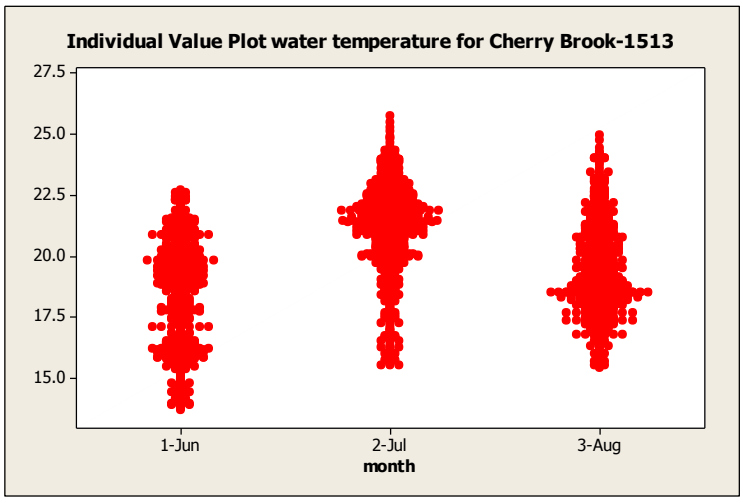
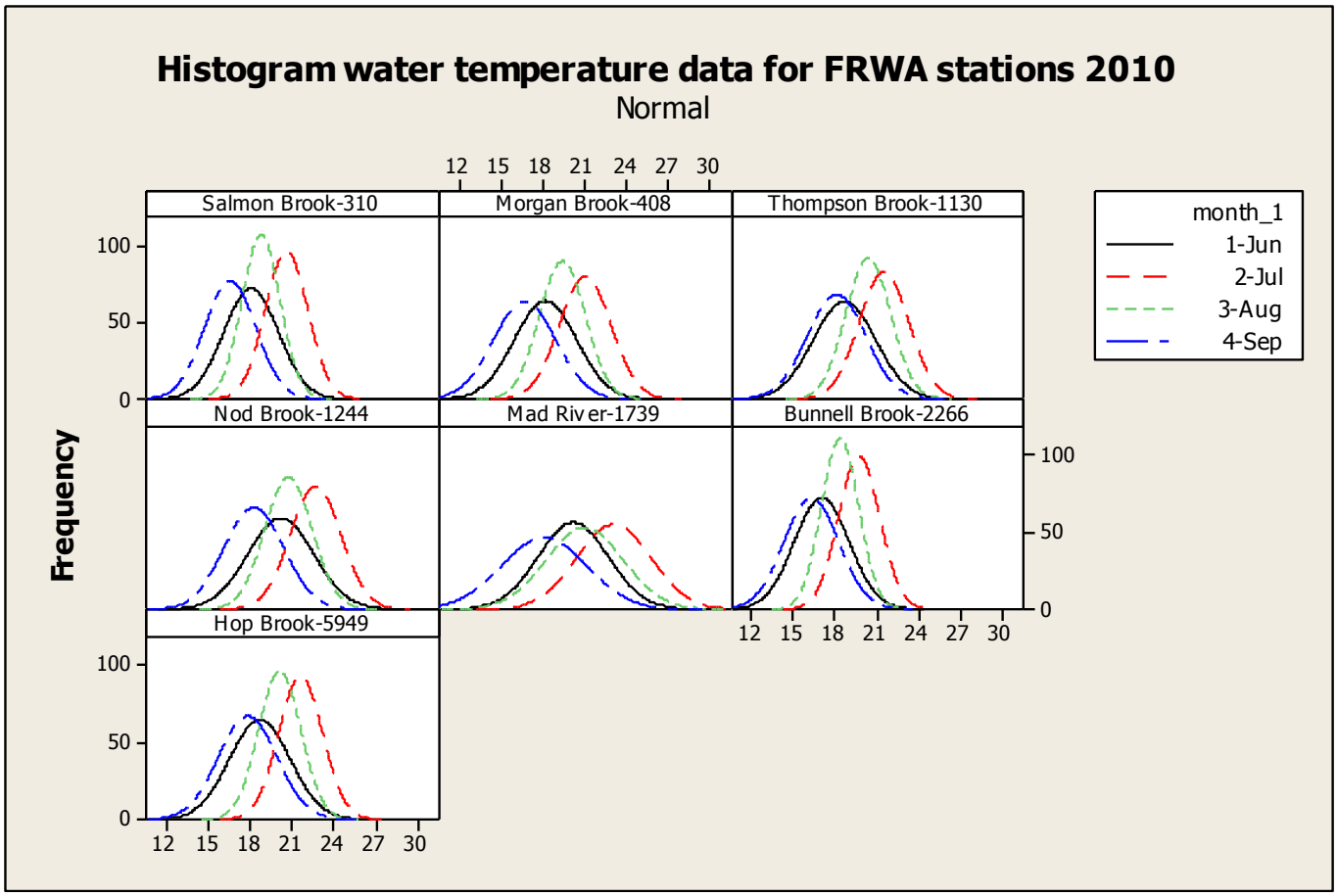


Figure 6. The distribution of hourly water temperature values by month recorded from June thru September 2010 for stations selected by the Farmington River Watershed Association. Each dot represents an observation. Similar values are plotted horizontally and different values vertically. Cherry Brook-1513 has 2208 data points from June thru August due to removal of the probe on 9/4/2010 and as such had to be inset as a separate graph.



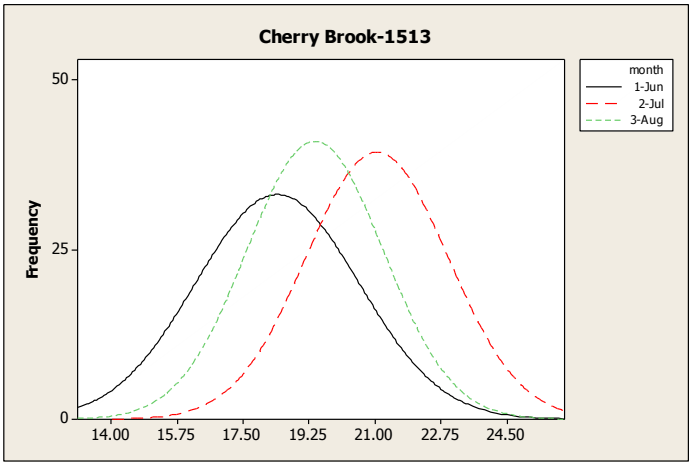


Figure 7. The distribution of hourly water temperature values by month recorded from June thru September 2010 for stations selected by the Farmington River Watershed Association. Cherry Brook-1513 has 2208 data points from June thru August due to removal of the probe on 9/4/2010 and as such had to be inset as a separate graph.

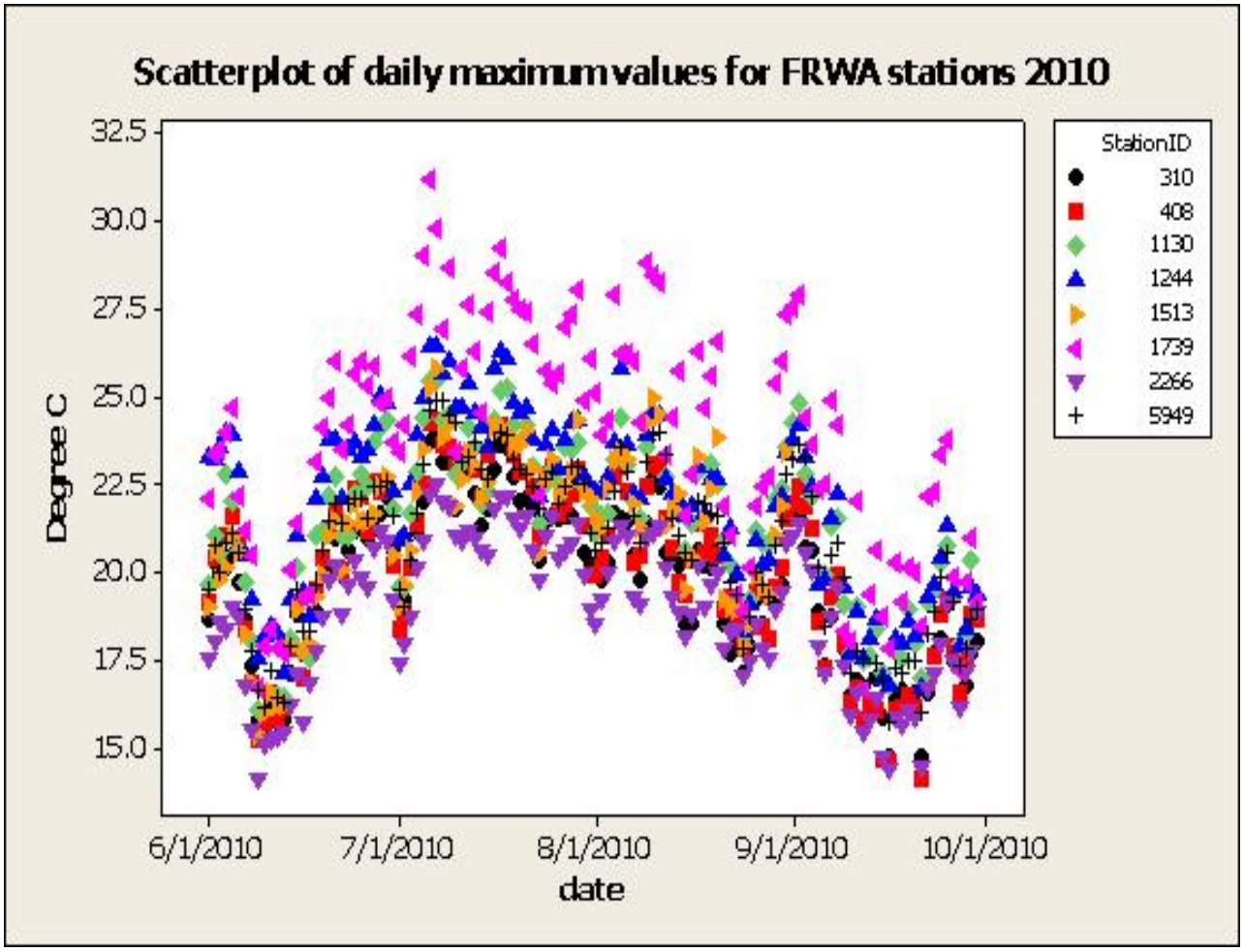


Figure 8. Daily maximum water temperatures for stations within the **Farmington River Watershed** during 2010. The warmest station appears to be 1739 (Mad River at the mouth in Winchester) by a quite a large difference. The coolest station appears to be 2266 (Bunnell Brook upstream Route 179, Burlington). All of the water temperature data appear to follow maximum and minimum air temperatures for the same period of time. An interesting feature on the plot is the rapid increase and then sharp decrease in early June. Cherry Brook-1513 has 2208 data points from June thru August due to removal of the probe on 9/4/2010.

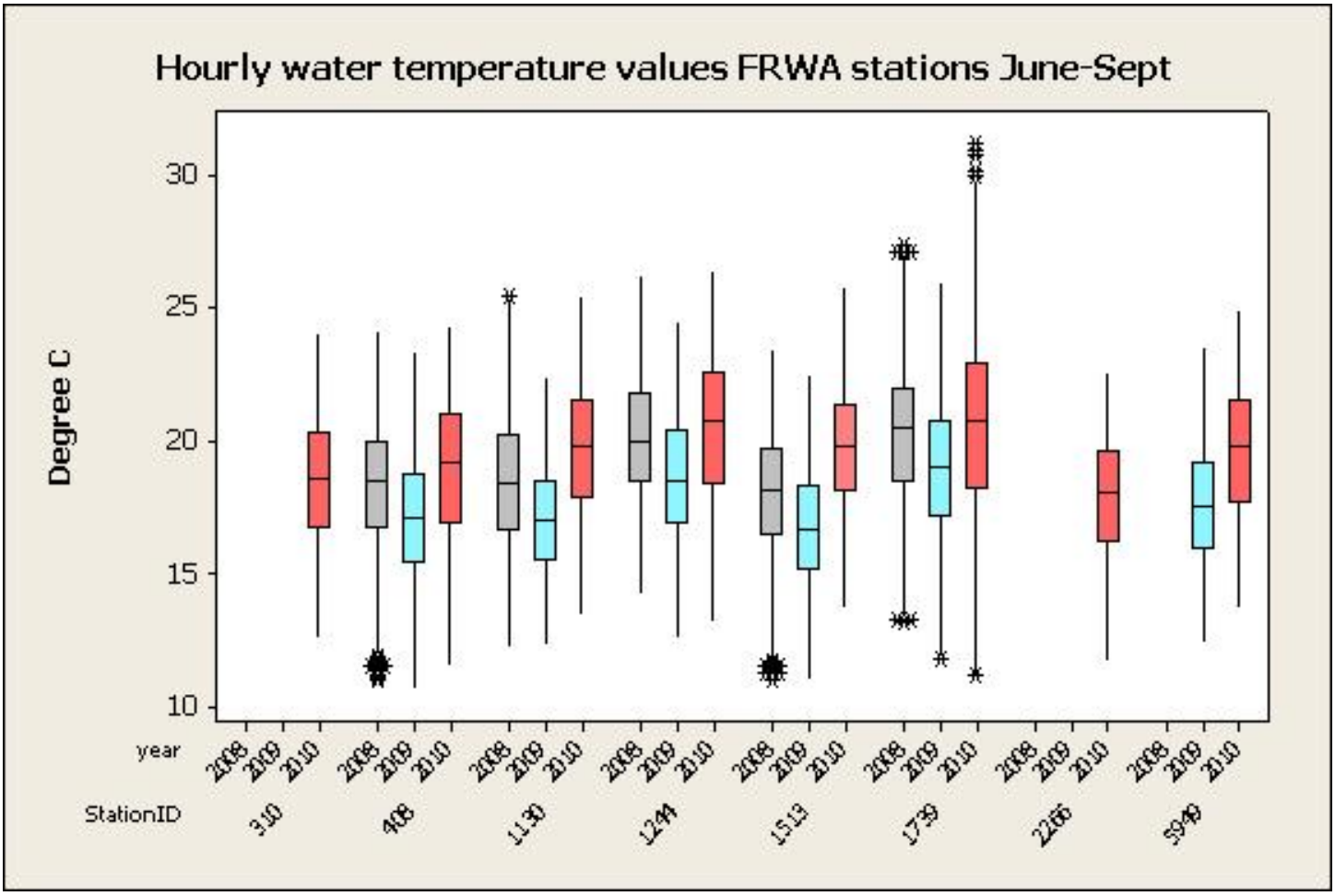


Figure 9. Box plot of water temperature data 2008 (gray), 2009 (light blue), and 2010 (red) from stations within the **Farmington River Watershed**. Water temperature is variable by station and year with 2009 being characterized as a cool wet summer and 2010 as a hot and dry summer. Based on overall distribution the warmest site appears to be 1739 = Mad River at the Mouth in Winchester, CT. The coolest appears to be 2266 = Bunnell Brook upstream of Route 179 in Burlington, CT. Two stations were added in 2010, Salmon Brook (310) in Granby and Bunnell Brook (2266) in Burlington. Cherry Brook-1513 has 2208 data points from June thru August due to removal of the probe on 9/4/2010.

THE NATURE CONSERVANCY-DEVIL'S DEN PRESERVE:

Table 3. Location of 6 HOBO deployments by **The Nature Conservancy-Devils Den Preserve** during summer 2010.

Station ID	Stream name	proximity	landmark	Basin id	Municipality	YLat	XLong	Segment ID
1304	Aspetuck River	at	Wells Hill Road	7202	Easton	41.22871	-73.3241	CT7202-00_01
1	Aspetuck River	US	Bayberry Lane	7202	Fairfield	41.18643	-73.3429	CT7202-00_01
1294	Saugatuck River	at	Keene Park Parking Lot	7200	Weston	41.19267	-73.3617	CT7200-00_02
1293	Saugatuck River	at	Weston Road past Lyons Plain Road	7200	Weston	41.1756	-73.3619	CT7200-00_02
2688	Saugatuck River	at	Wood Dam off Bolton Lane	7200	Westport	41.1495	-73.3661	CT7200-00_01
318	Saugatuck River	DS	Davis Hill Road	7200	Weston	41.22454	-73.3469	CT7200-00_02

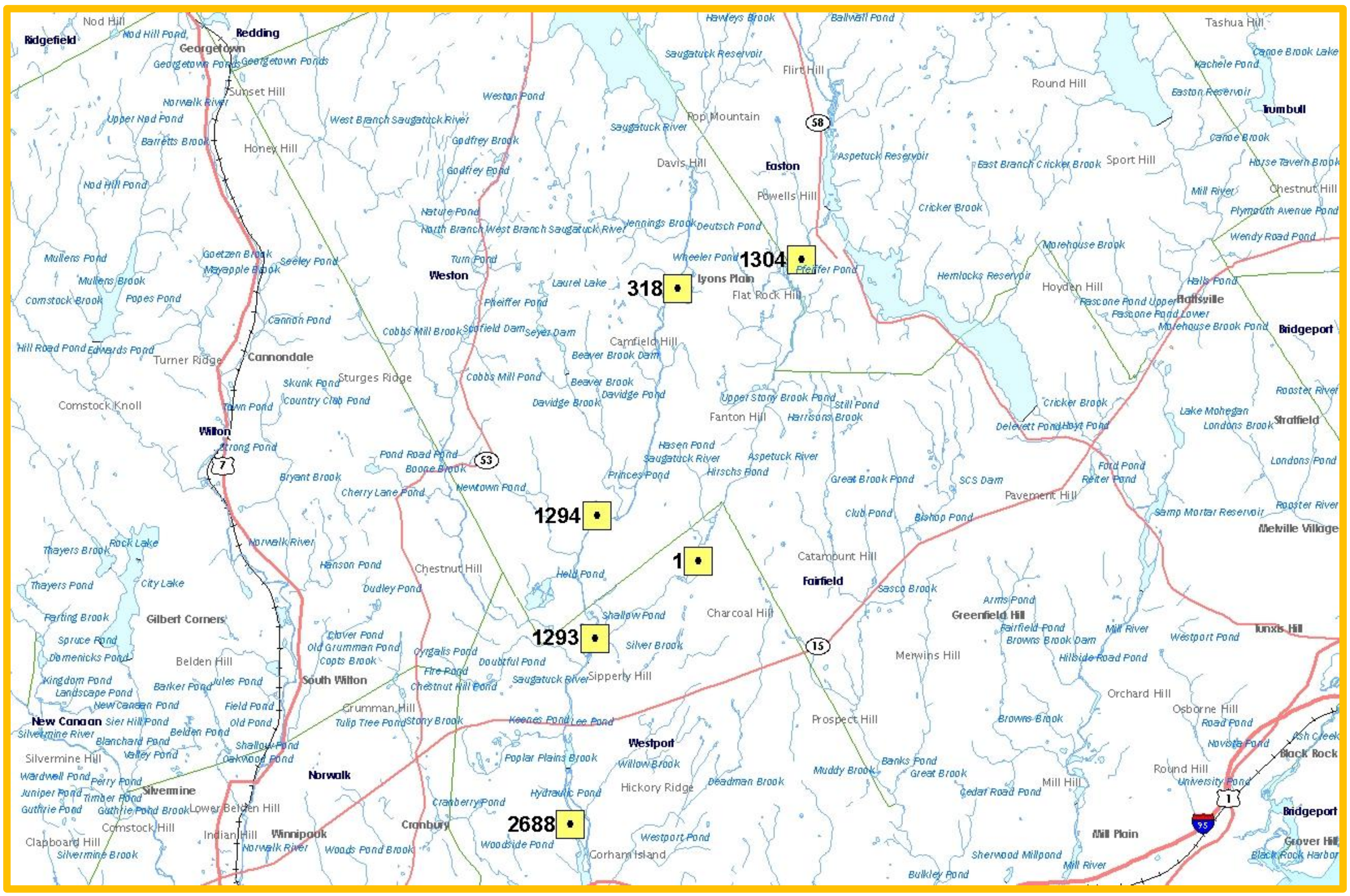


Figure 10. Location of 6 HOBO deployments by **The Nature Conservancy-Devils Den Preserve** during summer 2010. The number adjacent to the dot is the station id in Table 2 above.

Table 4. Summary statistics for each of the **Nature Conservancy-Devils Den Preserve** locations with a HOBO water temp pro. The hourly data are summarized between 6/1/2010 and 9/30/2010. Data are water temperature in Degrees C.

Stream	landmark	WPLR station ID	2010 month	Max temp	Min temp	Mean temp	Avg of daily max	Avg of daily min	Maximum minimum temperature
Aspetuck River	**Bayberry Lane**	1	June	25.0	15.8	21.2	22.2	20.3	23.4
			July	27.2	19.1	23.9	24.9	22.9	25.4
			August	25.7	18.9	22.3	23.1	21.5	24.1
			September	24.5	15.1	19.1	19.9	18.4	22.9
	Wells Hill Road	1304	June	24.3	15.2	19.3	20.4	18.3	22.0
			July	22.9	17.2	20.1	21.3	19.0	20.6
			August	22.7	16.0	19.3	20.4	18.5	20.2
			September	22.6	15.2	18.2	19.1	17.6	20.7
Saugatuck River	**Davis Hill Road**	318	June	18.8	12.6	15.9	16.7	15.1	17.0
			July	24.4	15.1	19.9	20.7	19.0	23.1
			August	26.2	19.6	22.8	23.8	22.0	24.2
			September	25.2	16.5	20.2	21.0	19.4	23.5
	Keene Park Parking Lot	1294	June	22.8	14.5	18.9	19.9	18.0	20.7
			July	24.9	17.1	22.1	23.2	21.1	22.9
			August	25.1	18.7	22.0	22.8	21.2	23.5
			September	24.4	15.4	19.1	19.8	18.4	23.0
	Weston Road past Lyons Plain Road	1293	June	24.0	14.9	19.8	20.9	18.8	21.8
			July	26.1	18.4	23.0	24.1	21.9	24.0
			August	26.1	18.9	22.3	23.3	21.4	23.8
			September	24.9	15.3	19.2	20.1	18.4	23.2
	Wood Dam off Bolton Lane	2688	June	27.1	18.2	22.5	23.4	21.9	25.2
			July	28.6	22.2	25.6	26.6	24.9	27.0
			August	27.6	20.5	24.3	25.1	23.7	26.2
			September	25.9	18.1	21.1	21.8	20.6	24.9

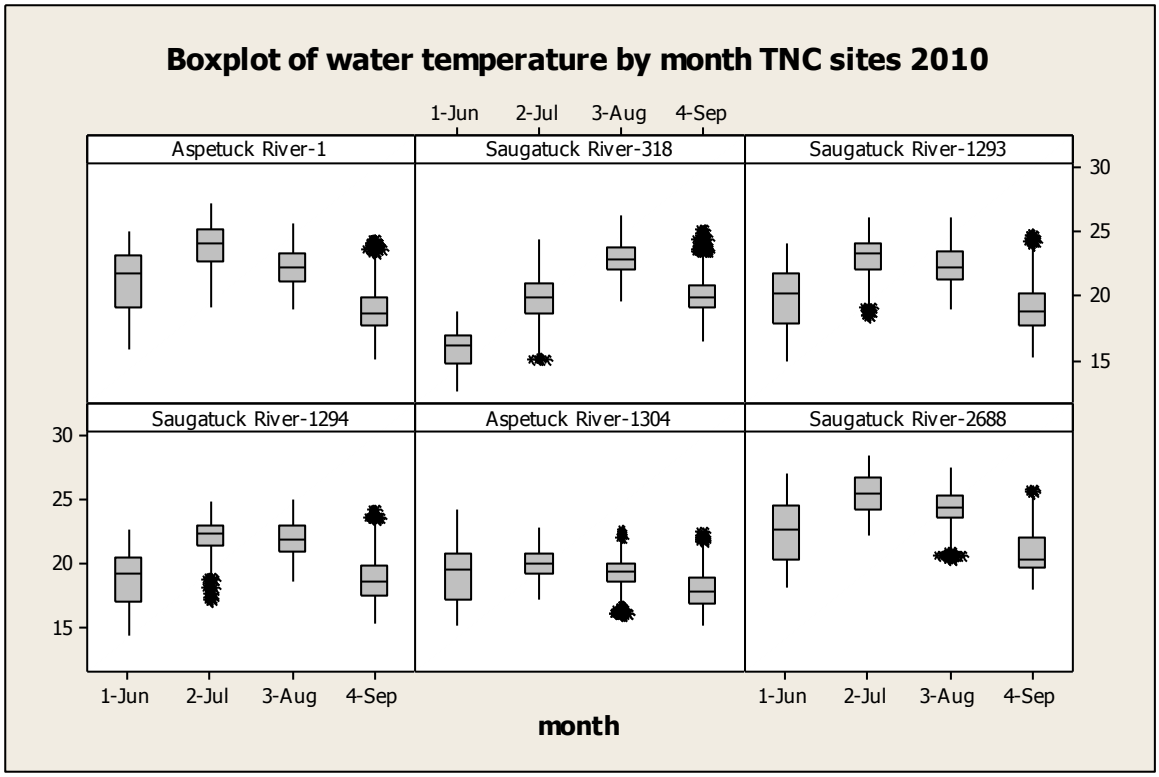


Figure 11. The distribution of hourly water temperature values by month recorded from June thru September 2010 for stations selected by TNC-Devil's Den.

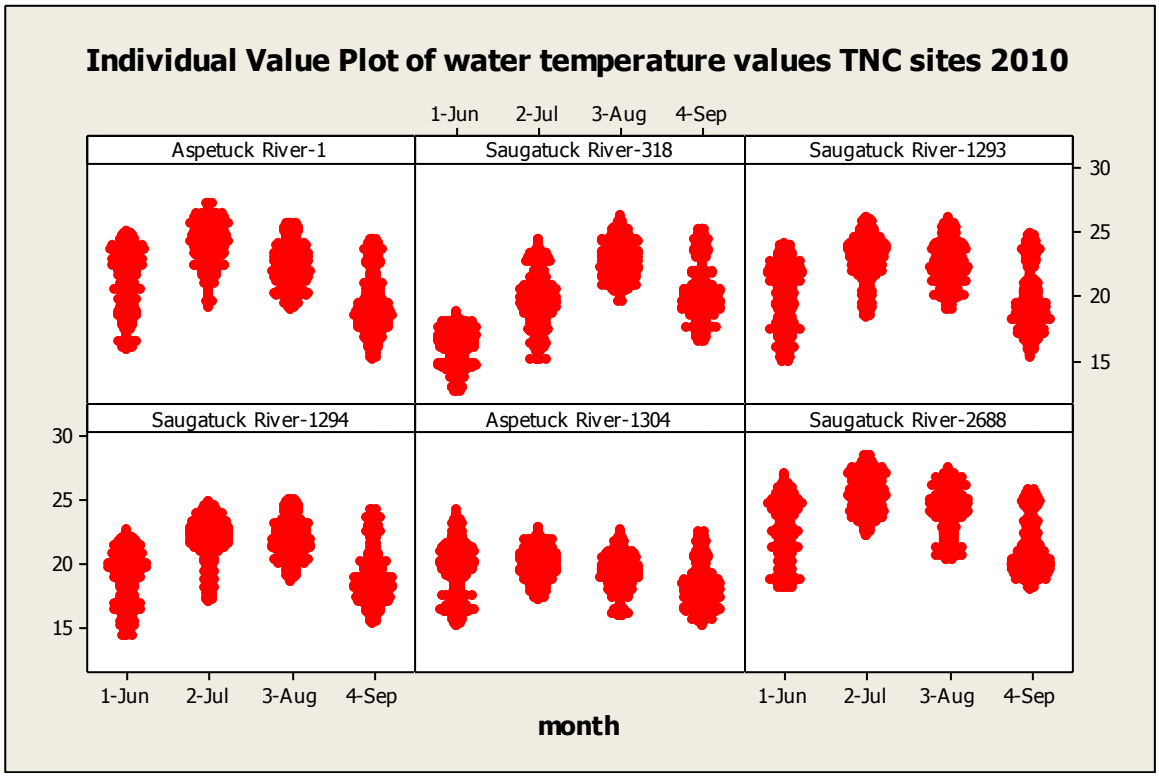


Figure 12. The distribution of hourly water temperature values by month recorded from June thru September 2010 for stations selected by TNC-Devil's Den. Each dot represents an observation. Similar values are plotted horizontally and different values vertically.

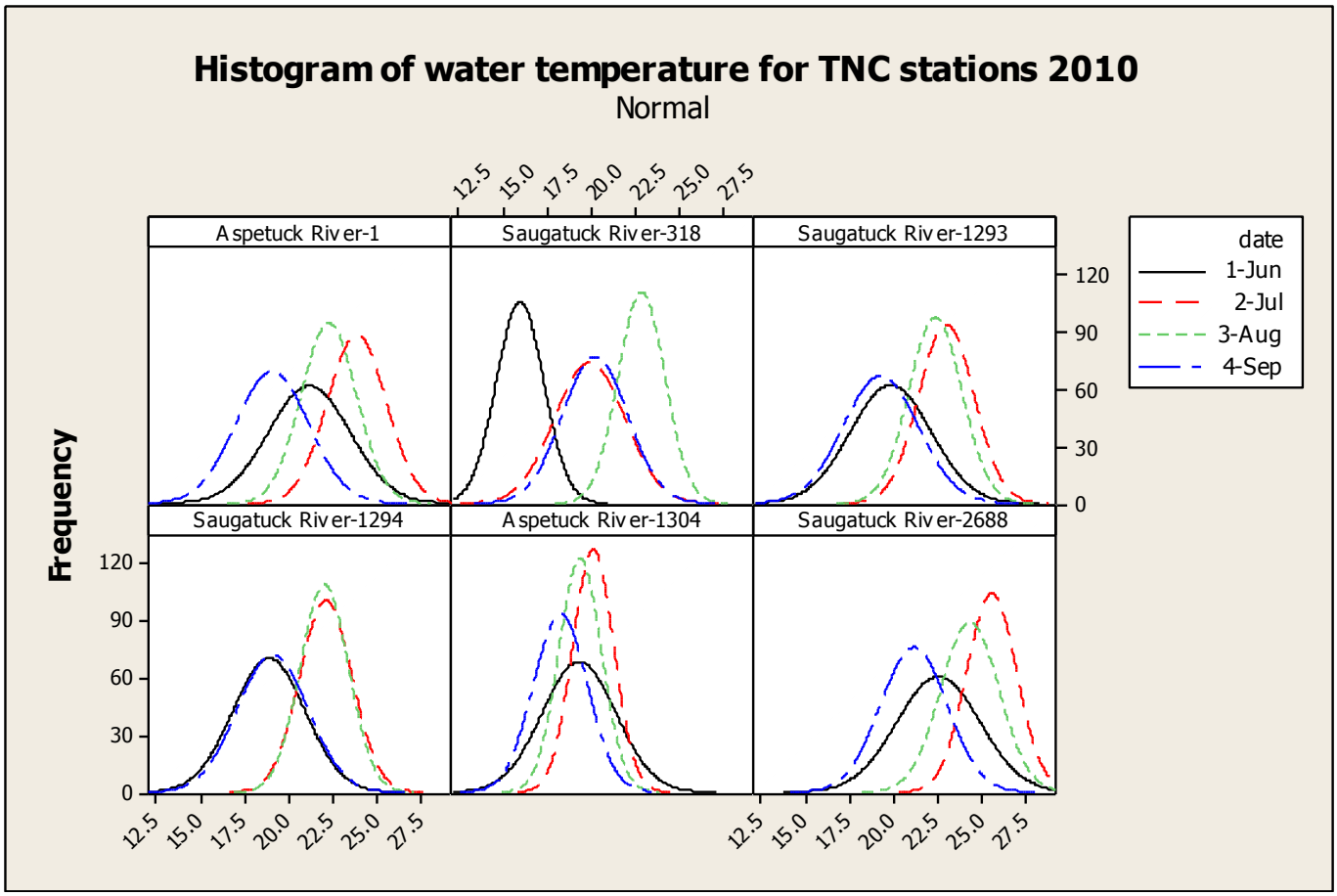


Figure 13. The distribution of hourly water temperature values by month recorded from June thru September 2010 for stations selected by TNC-Devil's Den.

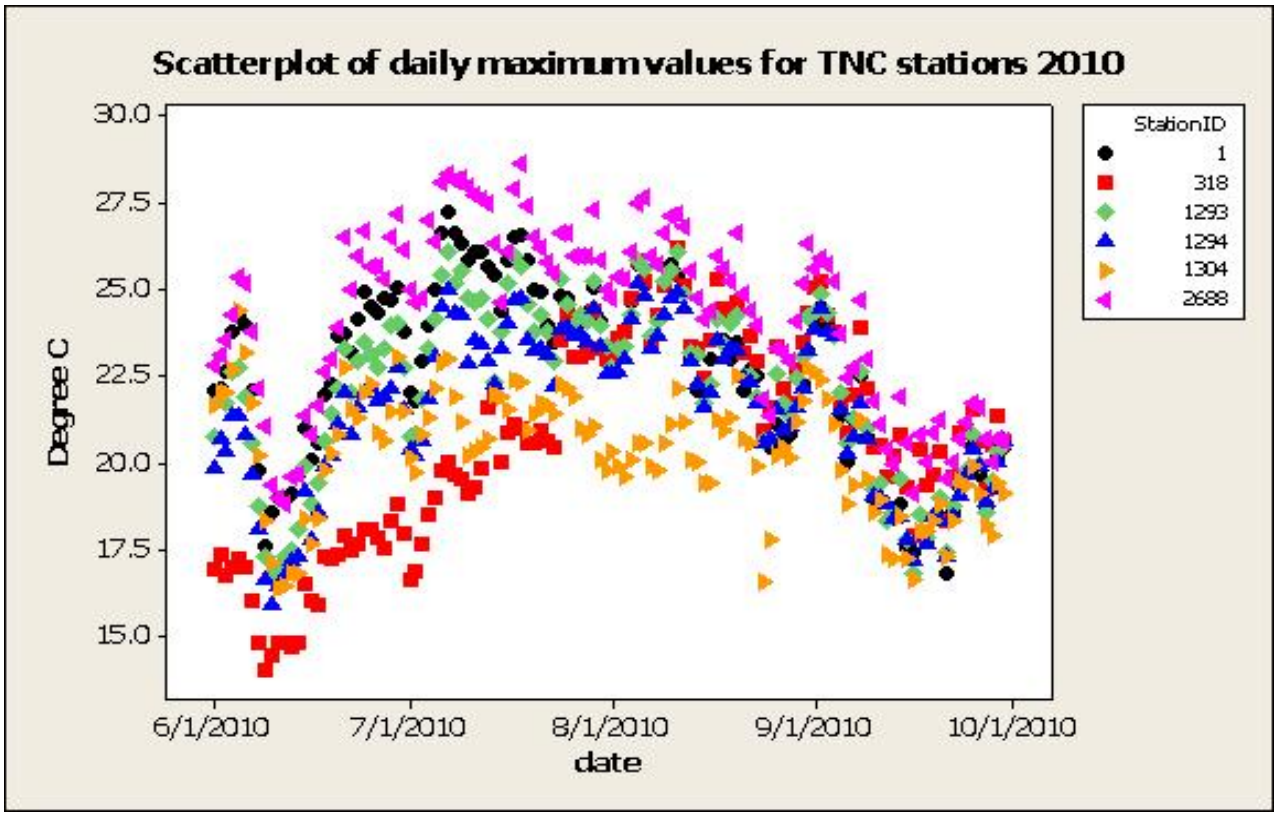


Figure 14. Daily maximum water temperatures for stations within the **Saugatuck River Watershed**. The warmest station appears to be 2688 (Saugatuck River at the head of tide in Westport). The coolest stations appear to be 318 (Saugatuck River at Davis Hill Road, Weston) until the end of July when the stream temperatures increase significantly from June and July values. This is probably related to the operation of the Saugatuck Reservoir upstream of this site. It would appear that the cold hypolimnetic release was either discontinued or was replaced by release of warmer surface water. The coolest site in August was station 1304 (Aspetuck River at Wells Hill Road, Easton). This may be related to operation of basin transfer of water from reservoir to reservoir. All of the remaining stations show patterns following maximum and minimum air temperatures for the same period of time. Both station id 318 (Saugatuck River at Davis Hill Road, Weston) and 1304 (Aspetuck River at Wells Hill Road, Easton) do not follow typical air temperature patterns.

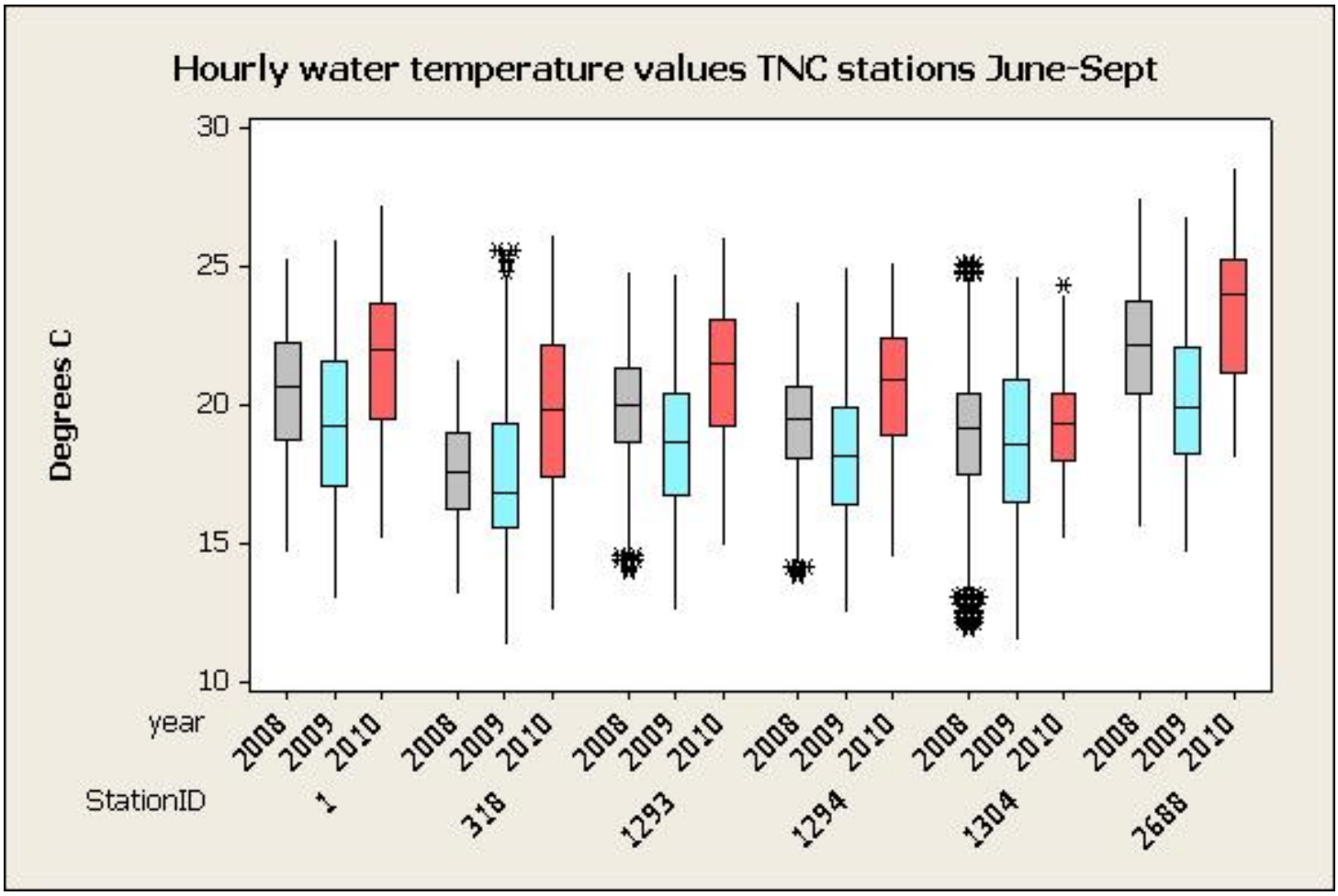


Figure 15. Box plots of water temperature values from summer 2008 (gray), 2009 (light blue), and 2010 (red) from stations within the **Saugatuck River Watershed**. Water temperature is variable by station and year with 2009 being characterized as a cool wet summer and 2010 as a hot and dry summer. Based on overall distribution the warmest site appears to be 2688 = Saugatuck River at the head of tide in Westport, CT. The coolest appears to be 1304 = Aspetuck River at Wells Hill Road in Easton, CT. This station is also the least variable across years for any TNC station.

TROUT UNLIMITED-CANDLEWOOD VALLEY CHAPTER:

Table 5. Location of 12 HOBO deployments by **Trout Unlimited-Candlewood Valley Chapter** during summer 2010.

Station ID	Stream name	proximity	landmark	Basin id	Municipality	YLat	XLong	Segment ID
2764	**Country Club Brook**	**US**	**Route 302**	**6019**	**Newtown**	**41.40824**	**-73.3059**	
1994	**Deep Brook**	**at**	**Deep Brook Road**	**6019**	**Newtown**	**41.4007**	**-73.3034**	**CT6019-00_01**
2473	Deep Brook	upstream	Bushy Hill Road in Dickenson park	**6019**	**Newtown**	41.3976	-73.3006	
2280	Deep Brook	upstream	Route 25	**6019**	**Newtown**	41.3977411	-73.2945784	CT6019-00_01
1993	Deep Brook	DS	Old bridge crossing	**6019**	**Newtown**	41.4022934	-73.2946709	CT6019-00_01
2278	Pootatuck River	at	Sandy Hook Center	**6020**	**Newtown**	41.4222305	-73.2820308	CT6020-00_01
2279	Pootatuck River	upstream	Confluence with Deep Brook (adjacent to Ag fields)	**6020**	**Newtown**	41.4123666	-73.2816845	CT6020-00_02
2761	**Pootatuck River**	**at**	**Walnut Tree Hill Road (mouth)**	**6020**	**Newtown**	**41.43755**	**-73.2702**	CT6020-00_01
2766	**Pond Brook**	**300 meters DS**	**Intersection of Pond Brook Rd and Obtuse Rd**	**6018**	**Newtown**	**41.44325**	**-73.3545**	
1523	**Pond Brook**	**at**	**Bridge at State Boat Launch**	**6018**	**Newtown**	**41.45969**	**-73.3275**	**CT6108-00_01**
2267	**Halfway River**	**DS**	**Route 34 adjacent to Old Bridge Road**	**6022**	**Newtown**	**41.38869**	**-73.1885**	**CT6022-00_01**
2763	**Halfway River**	**at**	**High Rock Road**	**6022**	**Newtown**	**41.36564**	**-73.2284**	

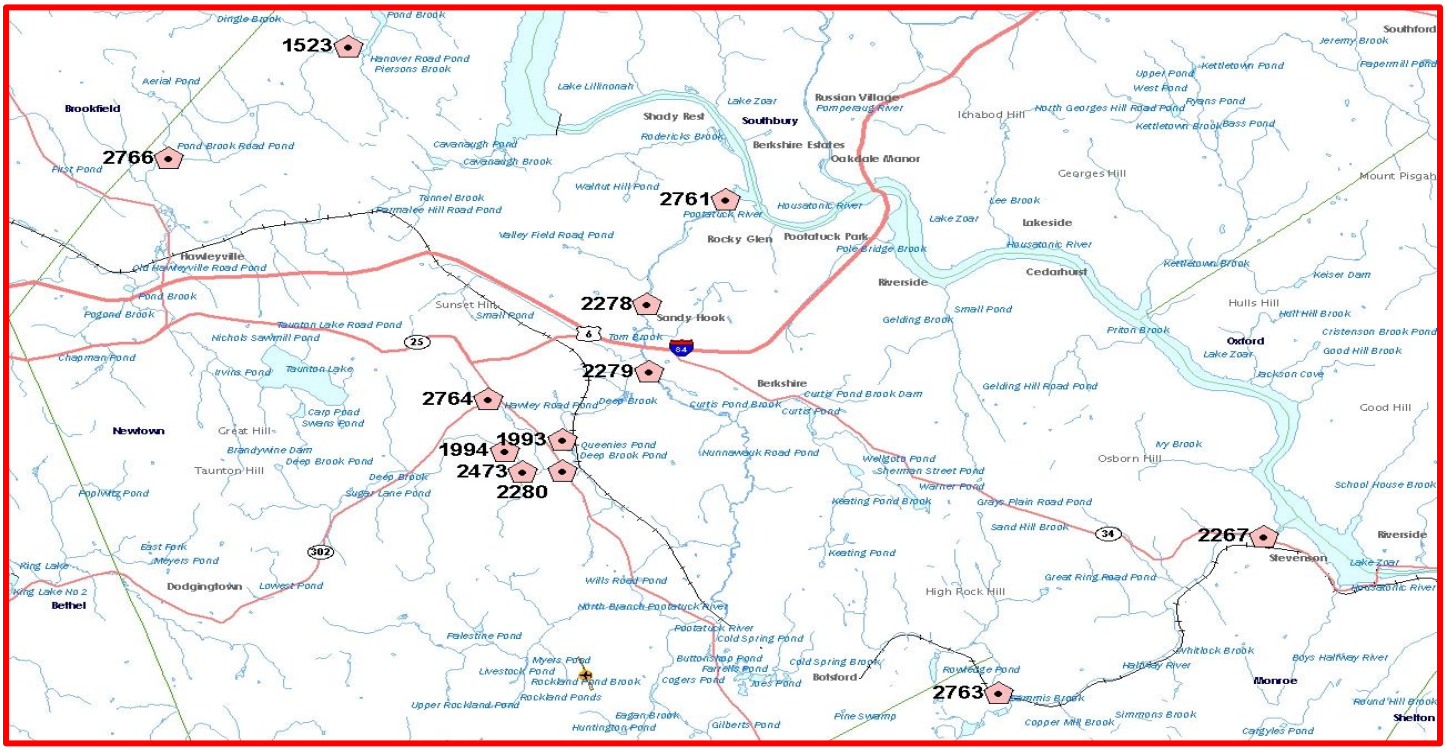


Figure 16. Location of HOBO deployment by **Trout Unlimited-Candlewood Valley Chapter** during summer 2010. The number adjacent to the dot is the station id in the Table 5 above.

Table 6. Summary statistics for each of the **Trout Unlimited-Candlewood Valley Chapter** locations with a HOBO water temp pro. The hourly data are summarized between 6/1/2010 and 9/30/2010. Values are water temperature in Degrees C.

Stream	landmark	WPLR station ID	2010 month	Max temp	Min temp	Mean temp	Avg of daily max	Avg of daily min	Maximum minimum temp
Country Club Brook	Route 302	2764	June	24.2	13.8	15.5	18.7	17.0	20.3
			July	24.9	15.6	18.2	21.2	19.7	21.9
			August	23.7	16.2	17.7	20.2	18.9	21.4
			September	21.6	13.5	15.6	18.1	16.8	20.1
Deep Brook	Bushy Hill Road in Dickenson park	2473	June	23.8	13.6	17.0	20.1	18.5	22.1
			July	25.6	16.8	18.4	22.8	20.4	22.6
			August	23.6	16.9	17.3	21.2	19.1	21.2
			September	23.0	13.7	15.1	19.1	16.9	20.4
	Deep Brook Road	1994	June	24.8	14.2	17.7	20.5	19.2	23.0
			July	26.1	16.9	19.6	23.2	21.5	23.8
			August	24.8	16.9	18.4	21.4	19.9	23.3
			September	23.8	12.8	15.7	18.4	17.0	21.6
	old bridge crossing DS Wassermann way	1993	June	25.8	15.6	18.9	21.1	19.9	23.7
			July	25.3	18.3	21.0	23.1	22.0	24.3
			August	24.6	18.3	19.5	21.4	20.3	22.8
			September	23.0	14.2	16.9	18.6	17.6	21.9
	Route 25	2280	June	25.7	14.7	18.3	21.2	19.7	23.4
			July	25.7	17.9	20.1	23.1	21.6	23.9
			August	24.7	17.6	18.6	21.5	20.0	23.7
			September	22.7	13.7	16.1	18.6	17.3	21.3
Halfway River	High Rock Road	2763	June	22.3	14.2	16.9	19.6	18.1	21.2
			July	24.5	16.6	19.5	22.1	20.8	23.1
			August	22.2	17.0	18.2	20.2	19.2	21.4
			September	21.6	13.5	15.8	17.8	16.8	20.6
	Route 34	2276	June	25.4	12.8	17.8	19.1	16.8	20.3
			July	20.8	14.7	20.3	21.4	19.4	22.7
			August	26.0	15.1	19.0	20.1	18.2	20.8
			September	21.2	11.9	16.4	17.6	15.7	19.7
Pond Brook	Bridge at State Boat Launch	1523	June	22.6	13.9	17.3	19.6	18.5	21.5
			July	24.3	16.7	19.6	22.3	20.9	23.2
			August	23.5	16.7	18.2	20.6	19.4	22.1
			September	22.3	13.6	15.8	18.1	17.0	21.0
	Intersection of Pond Brook Rd and Obtuse Rd	2766	June	24.2	14.6	17.8	21.0	19.4	22.6
			July	26.3	17.7	20.1	23.8	21.8	24.0
			August	24.4	17.4	18.5	21.6	20.0	22.7

			September	24.5	13.1	15.9	18.6	17.2	21.7
Pootatuck River	Confluence with Deep Brook (adjacent to Ag fields)	2279	June	23.1	13.9	17.2	19.7	18.3	21.6
			July	24.6	16.8	19.1	22.5	20.6	22.3
			August	23.7	16.8	18.0	21.2	19.4	21.6
			September	23.3	14.1	15.6	18.9	17.0	20.7
	Sandy Hook Center	2278	June	22.9	14.0	17.0	19.7	18.3	21.4
			July	23.8	16.9	19.1	22.0	20.5	22.3
			August	22.5	16.9	18.2	20.6	19.4	21.7
			September	21.6	14.4	16.2	18.2	17.1	20.4
	Walnut Tree Hill Road (mouth)	2761	June	24.0	14.8	18.3	20.5	19.3	22.6
			July	25.9	18.3	20.9	23.6	22.2	24.3
			August	24.8	18.3	19.7	22.1	20.9	23.7
			September	24.5	15.4	17.3	19.5	18.3	22.6

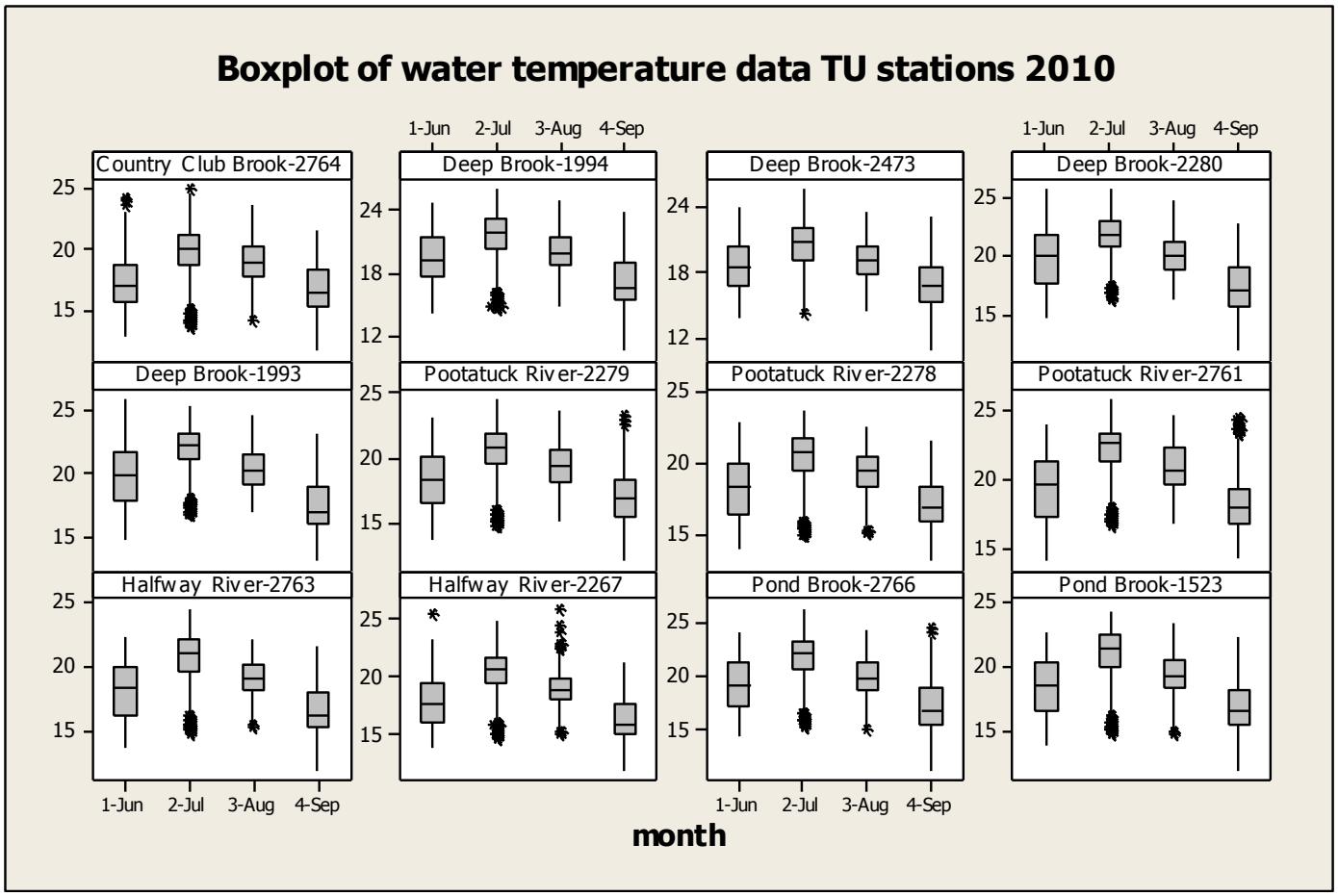


Figure 17. The distribution of hourly water temperature values by month recorded from June thru September 2010 for stations selected by TU.

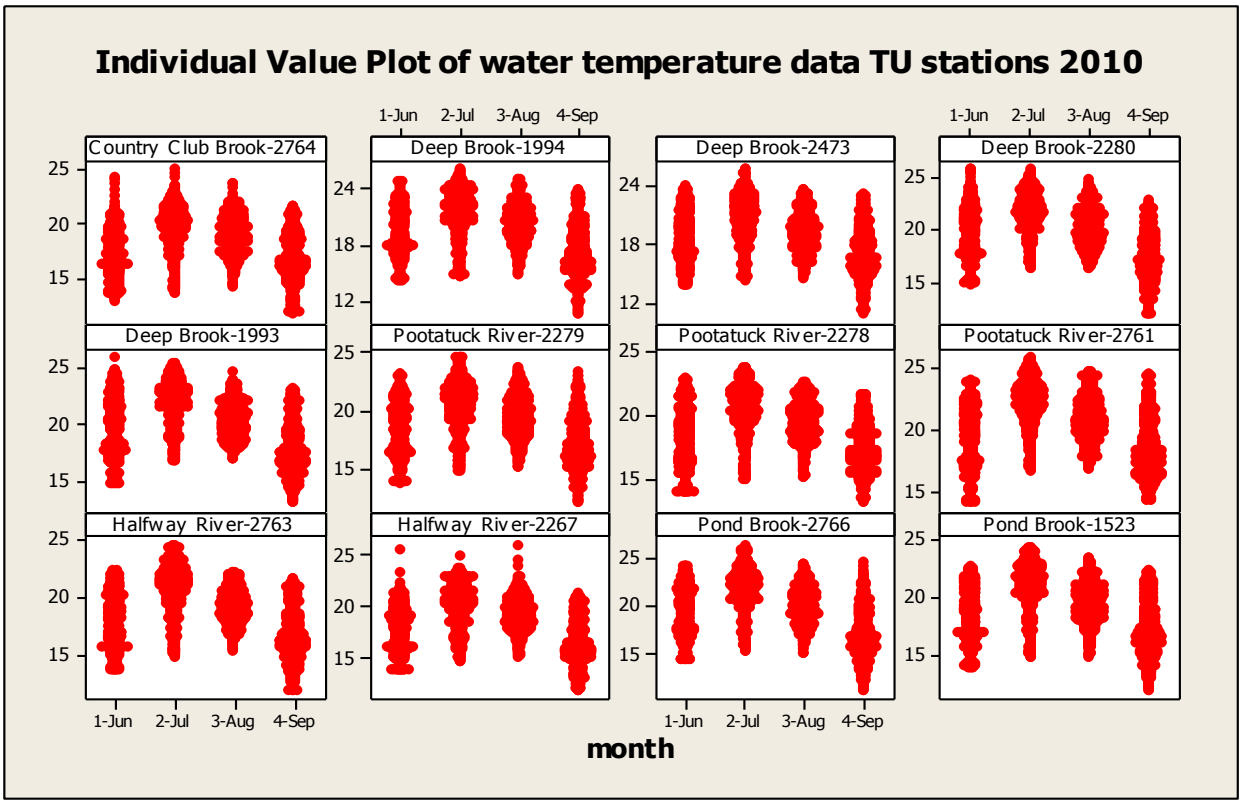


Figure 18. The distribution of hourly water temperature values by month recorded from June thru September 2010 for stations selected by TU. Each dot represents an observation. Similar values are plotted horizontally and different values vertically.

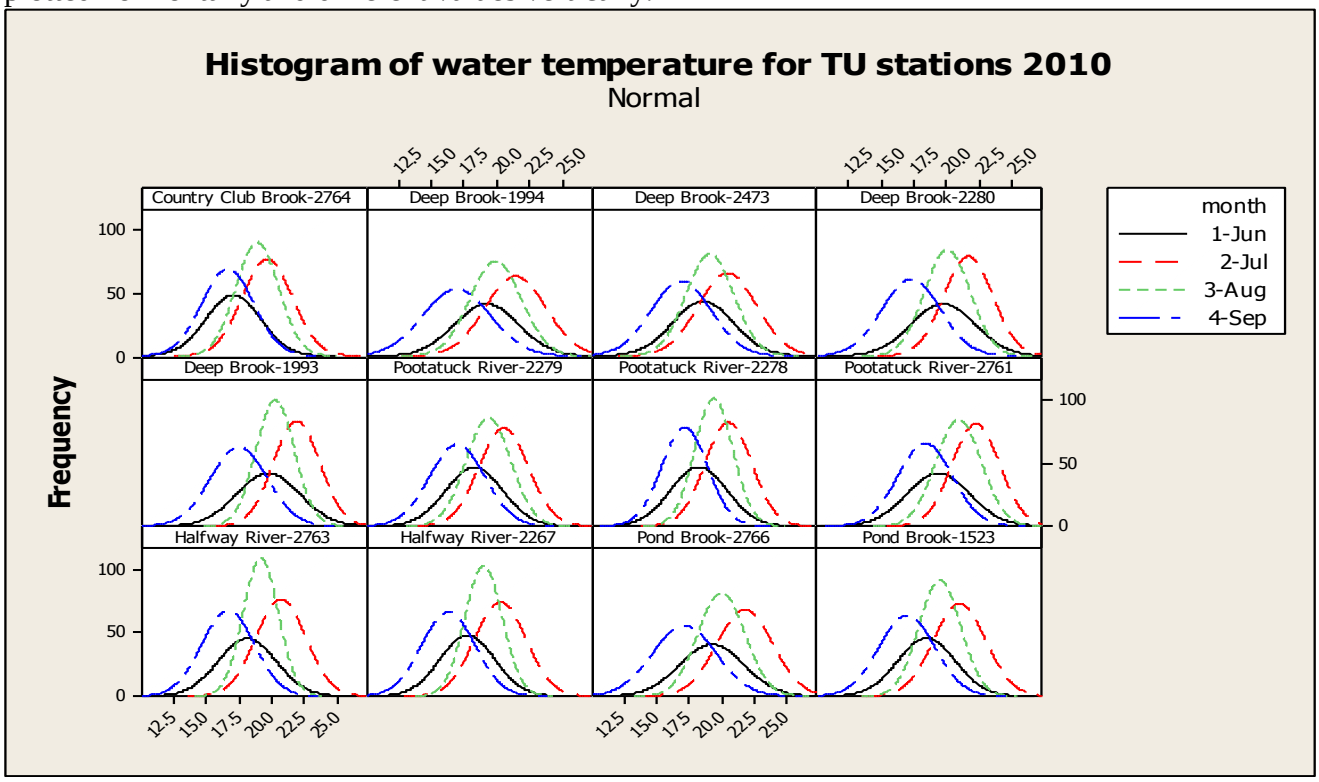


Figure 19. The distribution of hourly water temperature values by month recorded from June thru September 2010 for stations selected by TU.

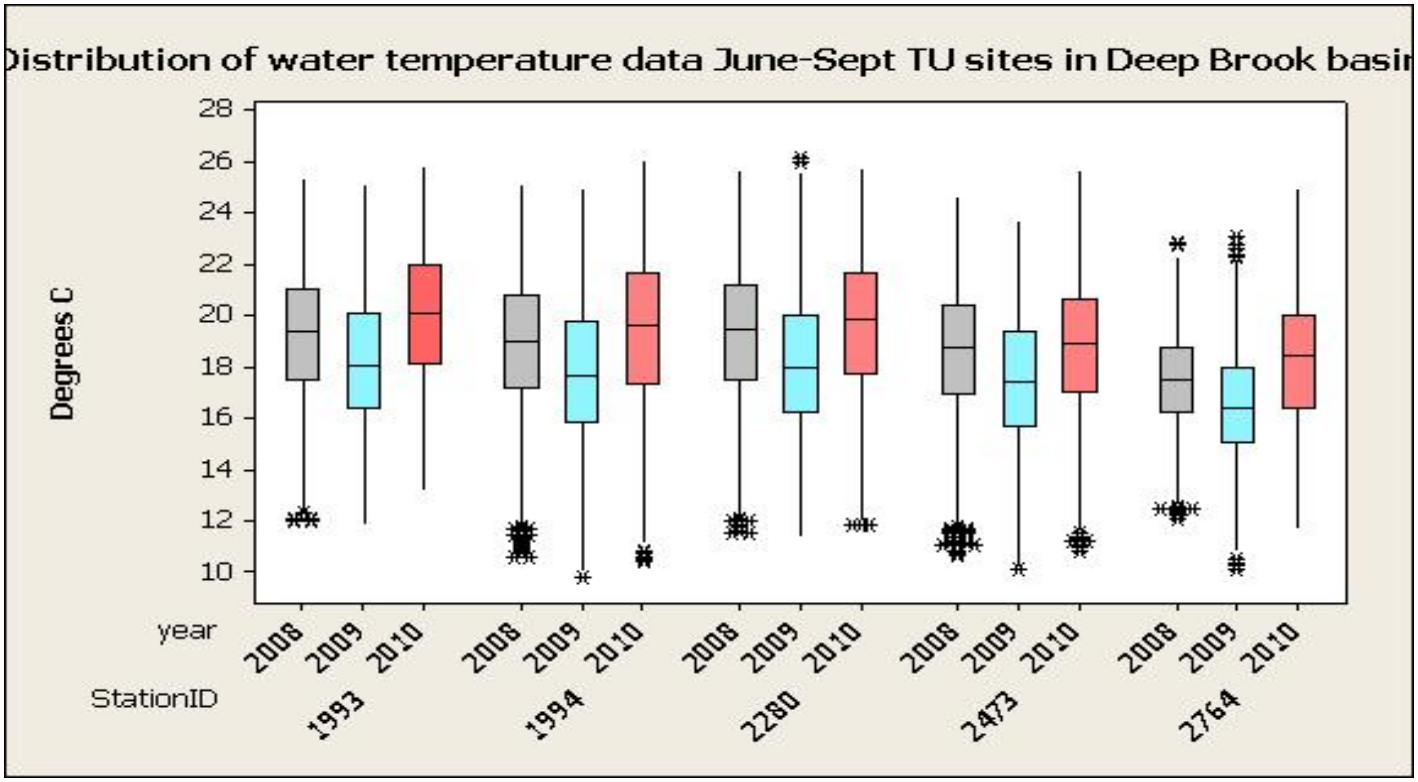


Figure 20. Box plots of water temperature values for summer 2008 (gray), 2009 (light blue), and 2010 (red) for stations within the **Deep Brook Watershed**. All of the stations appear to have similar temperature distribution and were slightly warmer than prior years. Data for 3 probes were not available as 2 probes were not recovered and in 1 probe the data was corrupt.

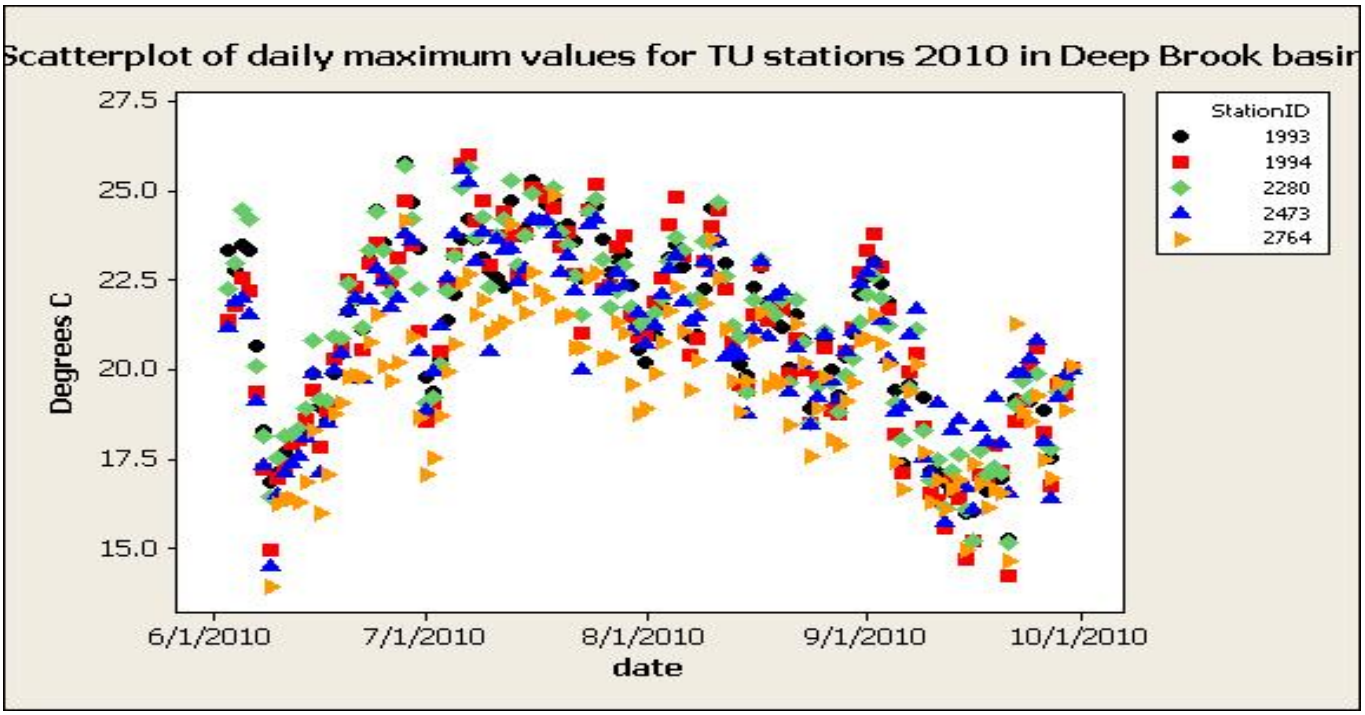


Figure 21. The daily maximum water temperature values for stations within the Deep Brook watershed summer 2010. Several stations are similar in daily maximum temperatures (stations 1994, 2473, 1993). The coolest is station appears to be 2764 (Country Club Brook upstream of Route 302, Newtown.).

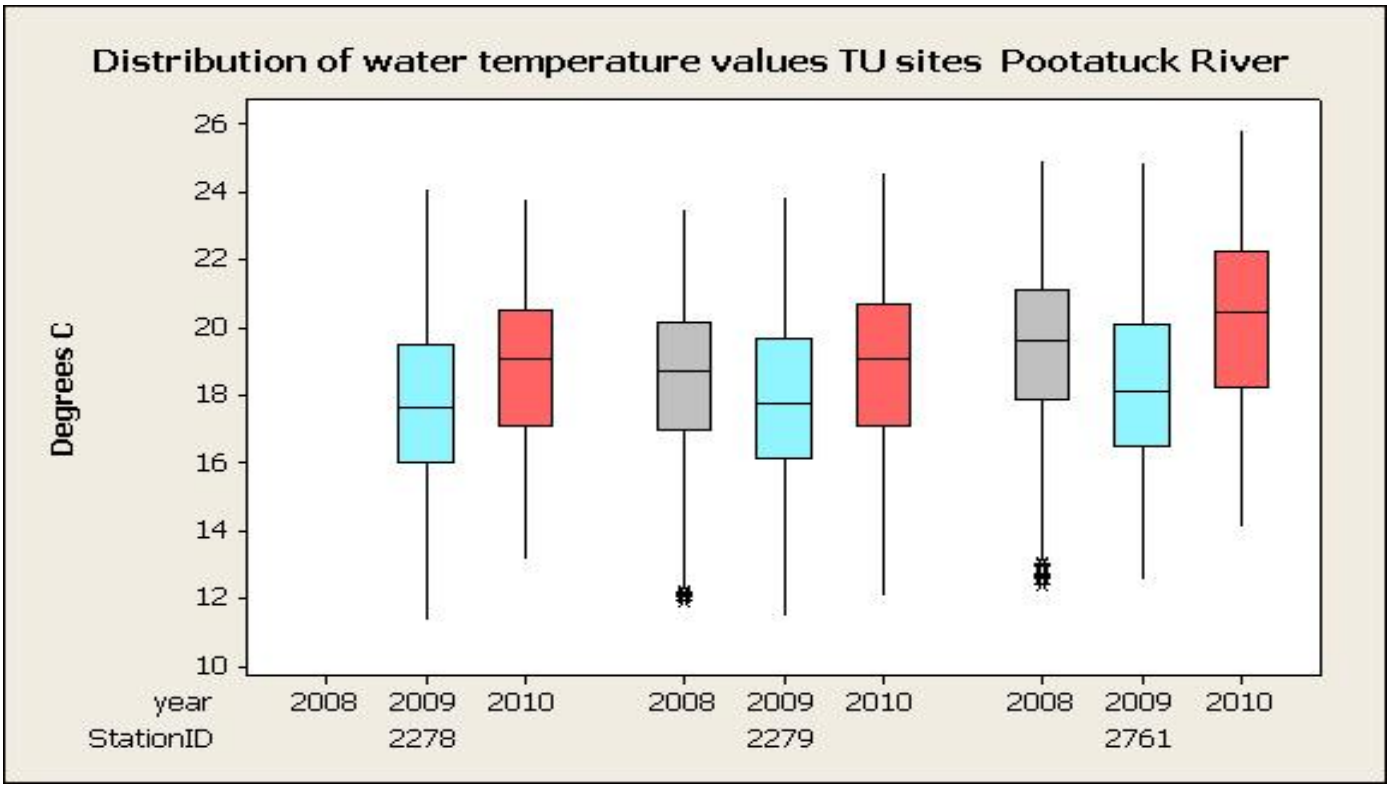


Figure 22. Box plots of water temperature values from summer 2008 (gray), 2009 (light blue), and 2010 (red) for stations within the Pootatuck River mainstem. All of the stations appear to have similar temperature distribution and were slightly warmer than prior years.

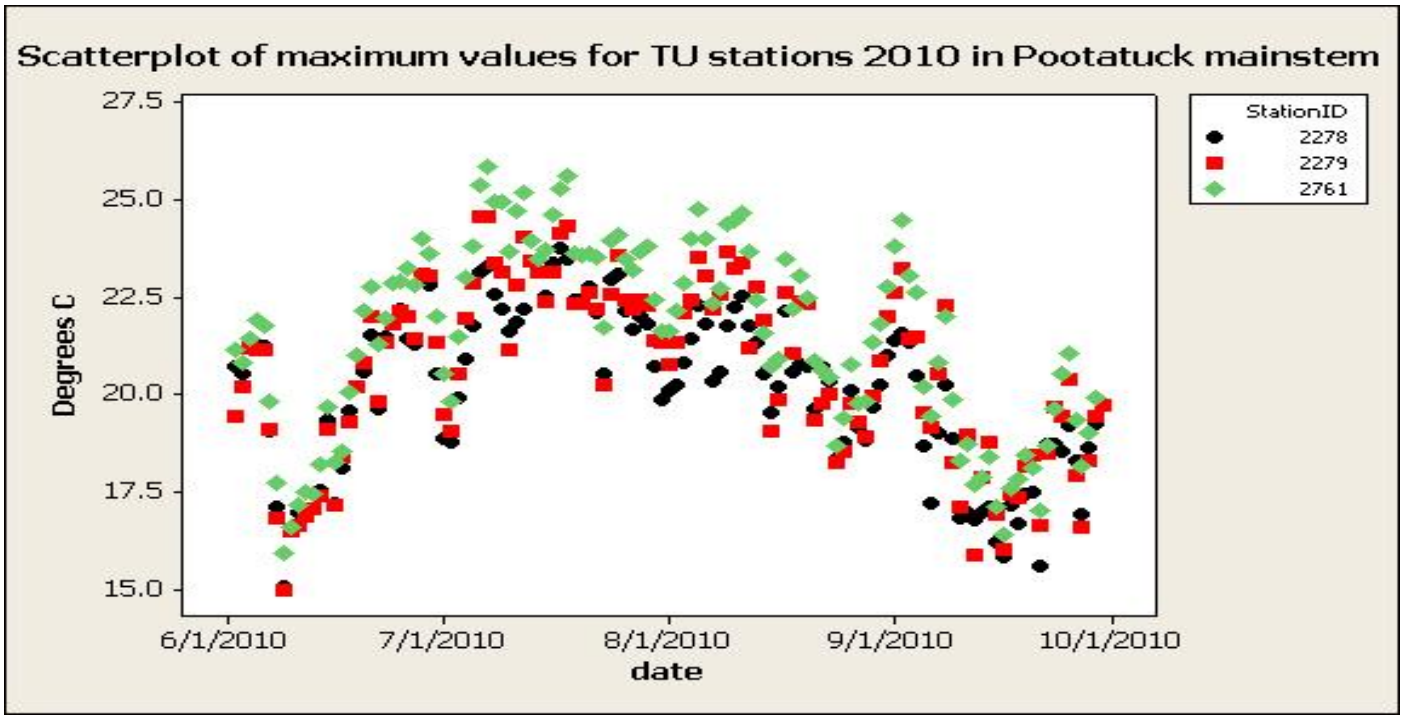


Figure 23. The daily maximum water temperature values for 3 stations along the Pootatuck River mainstem. Station 2761 (Walnut Tree Hill Road) near the mouth appears to be slightly warmer than the other stations.

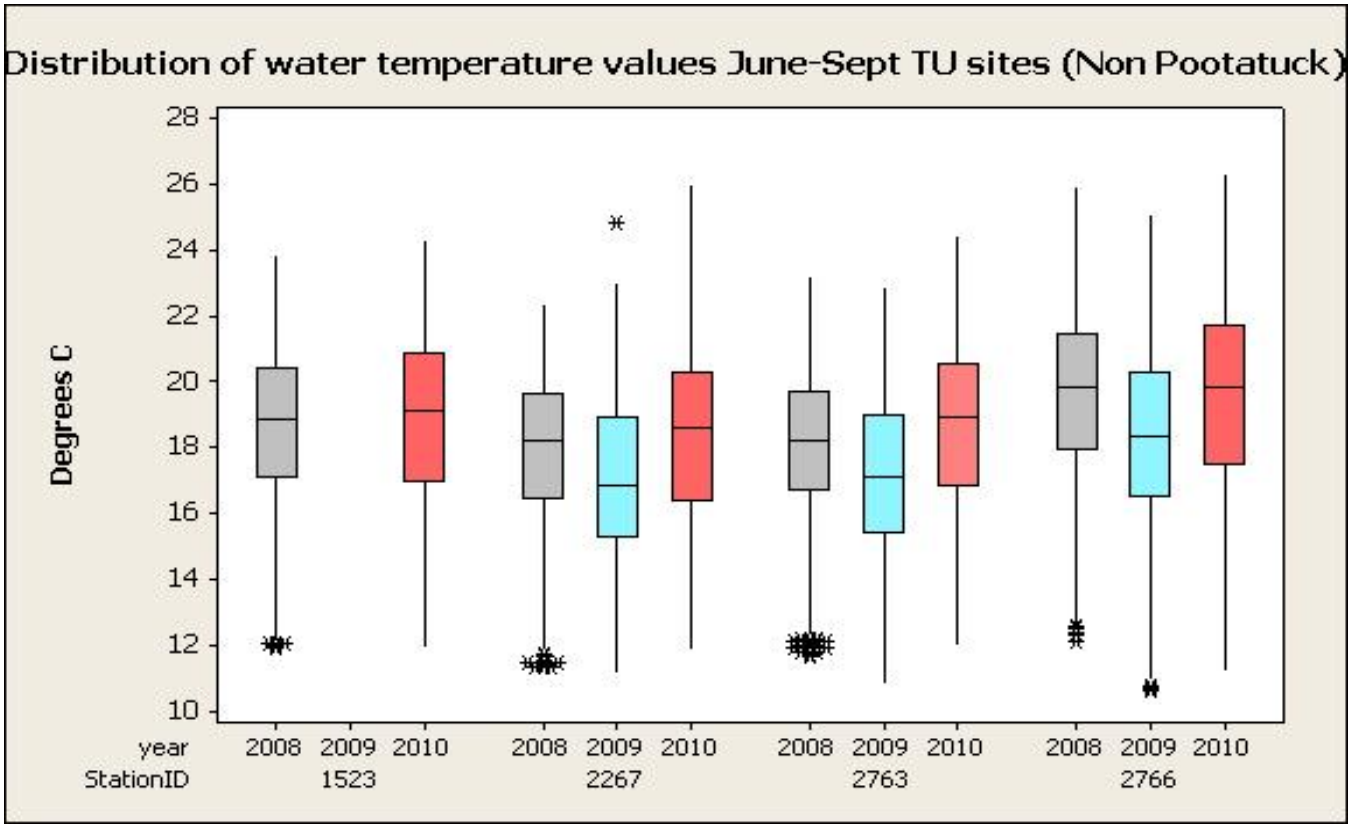


Figure 24. Box plot of water temperature data 2008 (gray), 2009 (light blue), and 2010 (red) for stations outside of the Pootatuck River watershed (Pond Brook and Halfway River). All of the stations appear to have similar temperature distribution and were slightly warmer than prior years.

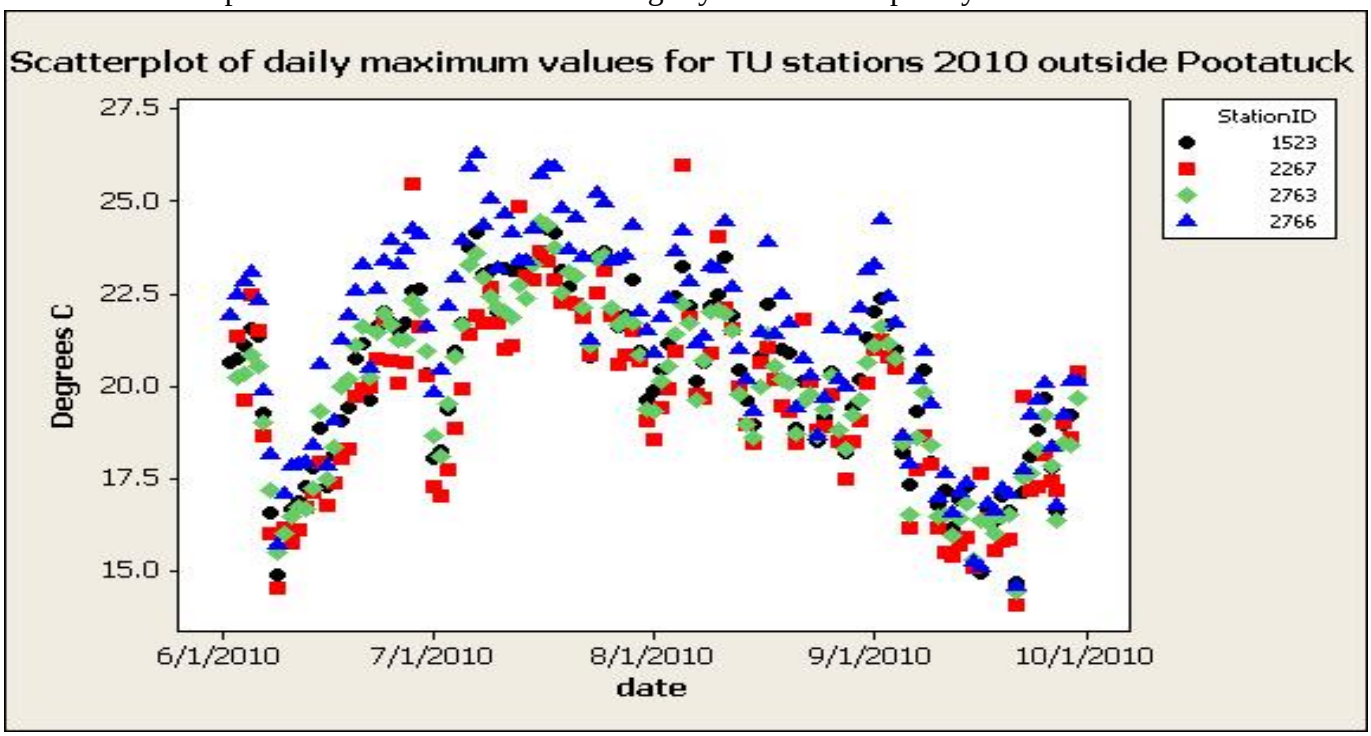


Figure 25. The daily maximum water temperature values for stations **outside the Pootatuck River watershed**, the warmest appears to be station 2766 (Pond Brook near Obtuse Road). The coolest are 2267 (Halfway River near Route 34) and 2763 (Halfway River near High Rock Road).